Preliminary note 1: in the “TOSTone.raw” function, the CI limits are computed as following: (m-mu) ± **t1-alpha/2,d**f\*SE while Blume et al. rather use (m-mu) ± **z1-alpha/2** \* SE

Preliminary note 2: all computations for TOST are done considering that the sampling distribution of (m-mu) follows a **normal** **distribution** N(m-m u,SE).

The TOST function is curved (because of the assumption of normality distribution) while the SGPV is straight line (no assumptions are made about the distribution, SGPV is only a proportion). However, some points overlap.

Let’s consider

* and the lower and upper limits of the null
* = the null interval
* and the lower and upper limits of the CI around (m-mu), and I = (m-mu)
* = the CI around (m-mu)
* m= the sample mean
* mu = the expected population mean

# **Anytime CI is entirely included within H0, the SGPV = 1. The TOST p-value can vary from 0 to alpha/2 (so it seems more discriminating)**

Reminder 1: when reporting equivalence test, one reports the one-sided test with the smaller t parameter (i.e when (m-mu) > 0 one reports tU; when (m-mu) < 0, one reports tL).

Reminder 2: anytime CI is entirely included in H0, |I| < 2\* |H0| =

* 1. **When = (see (a)) or =(see (b))**

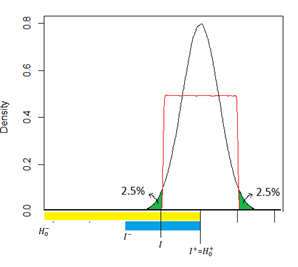
pTOST exactly equals

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

Why? *(Explanation for the upper limit of H0, the same explanation can be translated to the lower limit of H0)*

=I=lower limit of the 2-tailed confidence interval around

TOST p-value = P[((m-mu) <=I) **|** H0] = 2.5% (see Fig. below = probability to fall into the left-green area)



* 1. **When moves away from to 0 (moves away from to 0)**

pTOST **<** . The closer from 0, the smaller the pTOST. The smallest pTOST will be obtained when I=0 (i.e. when m = mu; see (c)). However, as long as a normal distribution theoretically goes from - to +, p-value will never exactly equal 0.

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |
| (c) |  |

**Conclusion: SGPV = 1 is like rejecting the null when 0 < pTOST ≤ .025 (so no novelty)**

# **Anytime the CI around I is exactly centered around** or **, pTOST=.5**

* If ≤ 2:

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

|I| is half out of |H0| half in |H0|.

* =
* = = =1/2.

pTOST also equals ½ because the 2-tailed CI around I = the 2-tailed CI around (or ) (it is symmetric around and then P[((m-mu) >=I) **|** H0] = the half area under the curve = .5).

* If > 2:

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

is entirely included within |I|

* =
* = =1/2.

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

pTOST also equals ½ because the 2-tailed CI around I = the 2-tailed CI around (or ) (it is symmetric around and then P[((m-mu) >=I) **|** H0] = the half area under the curve = .5).

# **Anytime CI is entirely out of H0, the SGPV = 0. The pTOST can vary from 1-alpha/2 to 1 (so it seems more discriminating)**

* 1. **When = (see (a)) or =(see (b))**

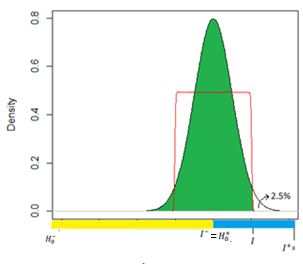
pTOST exactly equals 1 -

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

Why? *(Explanation for the upper limit of H0, the same explanation can be translated to the lower limit of H0)*

=I=upper limit of the 2-tailed confidence interval around

pTOST = P[((m-mu) <=I) **|** H0] = 1-2.5%=97.5% (see Fig. below = probability to fall into the green area)



* 1. **When moves away from (moves away from )**

Whatever ≤ 2 or not (as long as the numerator of is 0, )

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

pTOST **>** 1-. The further from , the bigger the pTOST. However, as long as a normal distribution theoretically goes from - to +, p-value will never exactly equal 1.

**Conclusion: SGPV = 0 is like accepting the null when 1 > pTOST ≥ .975 (so it’s not a real argument in favour of H1)**

# **Other cases ?**

See p\_tost\_converter.R

* 1. **If ≤ 2:**

When less than is included in ,

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

P\_tost > .5

When more than is included in ,

|  |  |
| --- | --- |
| (a) |  |
| (b) |  |

P\_tost < .5

In summary…

|  |  |  |
| --- | --- | --- |
|  | pTOST | SGPV |
|  | ≤.025 | 1 |
| ⊄ | ≥.975 | 0 |
|  | .5 | .5 |
| When less than is included in | .5 < pTOST < 1 | 0 < SGPV < .5 |
| When more than is included in | 0 < pTOST < .5 | .5 < SGPV < 1 |